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Obstructive Urinary Tract Lesions in Children

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OBSTRUCTIVE LESIONS of the urinary tract in children are almost entirely of congenital origin and are frequently associated with anomalies of the genital tract as well as of other unrelated parts of the body. They are located at the ureteropelvic junction, the ureterovesical junction, the neck of the bladder and the external urethral meatus. Occasionally obstruction is caused by ectopic position of a ureter.

Obstructions at the Ureteropelvic Junction

Obstructions at the ureteropelvic junction are of three general types: (1) high insertion of the ureter above the most dependent portion of the pelvis, (2) narrowing of the lumen of the pelvic outlet as a result of fibromuscular thickening of the ureteral wall in this area and (3) extrinsic bands with or without aberrant vessels impinging on the ureteropelvic junction. A mucosal valve located at the ureteropelvic junction may be added as a fourth type. Any combination of these may occur in a single case.

In most cases such lesions cause no symptoms while the child is young. As hydronephrosis develops, however, increased intrapelvic pressure causes pain, usually intermittent. Patients in whom infection develops have more symptoms and pyuria is usually persistent. The diagnosis is made by a complete study of the urinary tract. A hydronephrotic kidney can usually be palpated in a well relaxed

• Diseases that cause obstruction to the passage of urine in children almost always are owing to developmental defects. The most common site of obstruction in children, both male and female, is the neck of the bladder.

The importance of recognizing these conditions in the early stage of their development is emphasized by the fact that renal damage that may lead to failure occurs much more rapidly in children than in adults.

Symptoms are often insignificant. Recurrent or chronic infection in the urine should always be regarded as a warning sign. Investigation of the urinary tract in children is relatively easy, and with the improved methods of treatment now available, cure can be effected in virtually all cases in which irreversible changes in the kidneys have not occurred at the time of recognition.

child and palpation is perhaps more accurate if the child is lying on the abdomen. The location of the lesion is confirmed by roentgenographic study of the urinary tract. Intravenous or intramuscular urograms are diagnostic in many cases and may be supplemented by retrograde pyelo-ureterograms. Treatment is by the same kind of plastic procedures on the ureteropelvic junction as those carried out in adults, and destruction of a kidney as a result of hydronephrotic atrophy or pyonephrosis should rarely occur if the condition is recognized and treated early. The importance of early

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recognition is obvious if there is bilateral obstruction at the ureteropelvic junction or if the patient congenitally has but one kidney. It is important to determine whether or not the obstruction is bilateral, the amount of renal damage that has occurred and the presence or absence of other associated anomalies. A fused or "horseshoe" kidney is more liable to defective drainage than is a kidney that is normally situated. Hydronephrosis of clinical importance will develop in a few such cases. Surgical treatment entails division of the isthmus with lateral suspension of the lower poles of the kidneys combined with plastic reconstruction of the ureteropelvic junction or, in a few cases, removal of the hydronephrotic side.

Obstructions at Uterovesical Junction

Obstructions at the uterovesical junction are of two types: (1) ureterocele in which the obstruction involves only the mucosal orifice and (2) congenital narrowing of the entire intramural portion of the ureter. In the author's experience the former is chiefly unilateral and the latter bilateral. Damage to the upper urinary tract is in proportion to the degree of obstruction. Symptoms may be absent until severe hydronephrosis develops and may be initiated only by intervening infection. Uteroceles are sometimes quite large and may obstruct the internal vesical orifice and cause acute retention of urine. In females a portion of the sac may be extruded through the external urethral orifice. The treatment of uterocèles is simple. Opening the cyst with a cutting current and resection of the redundant mucosa is all that is necessary. In small children with large uterocèles this is more adequately done through a suprapubic approach. Strictures involving the intramural portion of the ureter may be treated by ureteral meatotomy or by severing the ureter where it enters the posterior wall of the bladder and reimplanting it into a different position. The author's experience with ureteral meatotomy has been unsatisfactory in that in too many cases scar tissue caused new obstruction. Good results have so far been obtained from reimplanting the ureters. Reimplantation is carried out exactly as it is in adults. Children lend themselves remarkably well to the procedure and they usually are able to leave the hospital in two to three weeks.

Obstructions at the Internal Vesical Orifice

Obstructions at the internal vesical orifice in children are much more common than is generally recognized. In a few cases the obstruction is caused by a congenital prostatic valve. (The condition was noted in three of forty-five cases observed by the author in which open operation was done.) The obstruction may be caused by the valves alone or

in conjunction with an enlarged verumontanum. Most obstructions at the internal vesical orifice in this age group, however, are caused by fibromuscular thickening in the area of the internal sphincter. There may be a complete contracture with involvement of only the posterior half of the neck of the bladder, simulating a prostatic bar in adult males. Obstruction of this type occurs about as often in females as in males. It is frequently associated with anomalies of the genital tract and in a surprising number of cases congenital absence of one kidney or some other associated anomaly has been observed. Not infrequently there are minimal symptoms or none at all until the upper urinary tract has become severely damaged, even to the point of irreversible renal failure. Frequency, straining, bed-wetting and overflow incontinence may occur. Any abnormal voiding pattern in a child should be promptly investigated. Infection is likely to occur and is usually persistent. Recurrent chills and fever are common. Infection added to the effects of back pressure increases the rapidity with which renal failure takes place.

Simple procedures are usually adequate to make the diagnosis. Intravenous urograms will indicate the functional value of the kidneys and usually any structural changes that have occurred unless the renal function has been severely damaged. Retrograde cystography is a most valuable procedure not only in establishing that there is obstruction at the neck of the bladder but also in indicating the amount of damage that has occurred as a result of the obstruction. One point that has probably not been emphasized as much as it should is that in many cases there is little residual urine even with a moderately dilated bladder. Recurrent or persistent pyuria is usual in such cases. A retrograde cystogram may be supplemented by cystoscopy but in most cases it is unnecessary. If the obstruction is recognized as early as it should be in the younger age group, the urethra is too small for insertion of an instrument that will provide adequate vision of the posterior urethra.

Surgical Treatment of Obstructions

Surgical procedures of two types have been used for the removal of obstruction at the neck of the bladder in children: transurethral resection and suprapubic or a modified retropubic approach. Transurethral resection has been widely used and is still a popular method in many medical centers. To the author, and perhaps to others, this procedure has not been uniformly satisfactory in small children. The urethra of a male infant will not accommodate an instrument of sufficient size to carry an adequate working element even with the aid of perineal urethrostomy. Hence, usually not

enough tissue is removed and repeated resection is necessary; and it should be emphasized that as long as any obstructive tissue remains, damage to the upper urinary tract continues and the urine if infected cannot be made sterile. Moreover, in small children transurethral instrumentation may cause urethral stricture. Transurethral resection may be quite adequate, however, for removal of obstructions in older children.

In 1948 the author started using a modified retropubic approach for removal of congenital obstructions of the neck of the bladder. In a child the neck of the bladder is higher in the pelvis than it is in an adult and is therefore easily accessible through an open approach. In the method used, the neck of the bladder is exposed through a low mid-line incision down to the symphysis. The bladder is opened immediately above the internal vesical orifice and the incision extended distally as far as is necessary to expose the entire posterior urethra even to the superior layer of the triangular ligament. All the obstructing tissue is easily removed by sharp dissection and the cut margins are approximated by a suture, which is usually adequate to control all bleeding. Only vessels from which blood spurts need be ligated. It is usually wise to cut completely through the wall of the bladder at this area in order to be quite certain that all obstructing tissue is removed. If the closure is adequate, there is no danger of urinary extravasation. Prostatic valves are destroyed by the high frequency current and enlargement of the verumontanum is treated in the same manner. The neck of the bladder is closed by continuous sutures and, unless the upper urinary tract has been decompensated by back pressure, drainage is accomplished by an indwelling urethral catheter, which is removed at the end of a week. If the patient has a large atonic bladder and especially if there is ureteral reflux, suprapubic drainage should be employed as long as is necessary to permit the upper urinary tract to return to normal. From six months to one year may be required. Children seem to tolerate suprapubic drainage remarkably well.

Results of Surgical Treatment

Forty-five children, 25 of them boys, were treated by this method. The only complication of importance was epididymitis which developed in one child after discharge from the hospital. The maximum duration of hospitalization was 18 days. Results were uniformly good in all 45 cases.

Pinpoint External Urethral Meatus

A pinpoint external urethral meatus is said to be one of the most frequently encountered obstructions of the lower urinary tract. However, the

author has observed it less often than obstruction at the internal vesical orifice. Nevertheless, this simple obstruction can be of as much clinical importance as the latter lesion and cases have been reported in which renal failure has occurred. One of the most important features of a pinpoint meatus is recognition of its presence and the complications that can arise as a result of it. Treatment consists in meatotomy followed by passage of sounds. Since it is not unusual for a patient to have obstruction at more than one site—pinpoint meatus and obstruction of the neck of the vesicle, for instance—the urinary tract must be completely studied in all cases. Pinpoint meatus is not infrequent in females and can be quite as important as the equivalent condition in males.

Duplicated Ureters

Duplication is one of the commonest anomalies of the upper urinary tract. If the duplicate ureter opens in normal position at the lateral angle of the trigone and there is no obstruction, it is of no clinical importance. In a large proportion of cases, however, the duplicate vessel opens in an ectopic position, such as the posterior urethra, seminal vesicles, rectum, uterus, vagina, anterior urethra or Bartholin gland. In all such cases drainage is defective and there is hydronephrosis of the renal segment that is served by the ectopic ureter, most often the upper pole. If the duplicate ureter opens into the posterior urethra there may be no symptoms until, infection complicating the condition, the patient has pain in the renal area and recurrent chills and fever. Not infrequently in such circumstances chills and fever follow exercise. Usually in intravenous urograms the pelvis on the involved side appears to be normal but not in a normal relationship to the total renal shadow. In many cases the function of the involved segment of the kidney is reduced to the extent that the contrast medium will not concentrate in it, and the diagnosis then depends upon detailed search of the posterior urethra for the ectopic ureteral orifice. Frequently it can be located by injecting indigo carmine intravenously, then compressing the kidney bimanually during the search to force urine into the visual field. This method is useful, however, only if some degree of function has been maintained in the segment of kidney that drains through the ectopic orifice. Always when the orifice opens distal to the external sphincter there is constant dribbling of urine.

The history in such cases is characteristic. The child urinates at normal intervals and in normal amounts (indicating that there is a bladder and a competent external sphincter) yet is constantly wet.

The majority of patients observed by the author were girls. The ectopic orifice was more frequently seen in the posterior margin of the external urethral orifice than in any other location. Pyelo-ureterographic visualization of retrograde catheterization of the ectopic ureter will identify the kidney to which it is attached and show the amount of dilation of the ureter and the renal segment.

Treatment is surgical. In view of the fact that in duplicated pelves the upper pelvis serves only one-fourth to one-third of the total renal mass, resection of that portion can usually be accomplished with preservation of enough renal tissue on that side to support life even in the absence of the opposite kidney. In cases in which the involved segment of the kidney has maintained good function the ureter may be reimplanted into the bladder. This would be especially indicated in cases in which the lower pelvis is involved. Anastomosis to the adjoining ureter or implantation into the rectosigmoid colon is not to be considered in the management of ectopic ureters.

Dilated Tortuous Ureters

Another kind of obstruction is that which occurs from dilated tortuous ureters as a result of obstruction at some point in the lower urinary tract. After the primary obstruction is removed, dilated tortuous ureters have a tendency to return to normal length and diameter. On the other hand, if the obstruction has been complicated by infection, frequently periureteritis develops with adhesions be-

tween the loops of ureter that prevent the normal recuperative tendency.

Treatment consists in freeing the ureter, resection of the redundant portion (frequently as much as one-third to one-half of the entire length) and reanastomosis of the upper and lower segments. The urinary stream may be diverted by ureterostomy above the point of anastomosis or by nephrostomy.

Infected Urine

Infected urine is a frequent sign of an obstructive lesion in some part of the urinary tract. It is the usual practice in the majority of medical centers to make a complete study of the urinary tract after the second or third attack and such studies are mandatory in all cases of persistent pyuria. Intravenous urography in the majority of cases will supply all the information needed or it will indicate the necessity for supplementary studies. The contrast medium is tolerated almost entirely without reaction and a proportionately larger dose can be given than is ordinarily administered to adults, thus increasing the likelihood of obtaining diagnostic visualization.

A point to be borne in mind with regard to obstructions of the urinary tract is that in children there is in general good prospect for salvage. In many cases in which there seem to be irreversible changes, relatively normal function will be regained after adequate surgical treatment.

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